86 00755

The SEISMIC SAFETY Element

of the

RICHMOND GENERAL PLAN

September 1974

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Seismic Safety Element

The Seismic Safety Element of the General Plan

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PART ONE: INTRODUCTION

Background of the Study

In recent years there has been a growing concern over hazards of earthquakes and other seismic hazards. As one expression of this concern, in 1972 the California Legislature adopted a law requiring counties and cities to complete a Seismic Safety Element as part of their General Plans. According to State law, the Seismic Safety Element must consist of an identification and appraisal of seismic hazards such as susceptibility to surface rupture from faulting, to ground shaking, to ground failures, and to the effects of tsunamis and seiches. The Seismic Safety Element shall also include an appraisal of mudslides, landslides, and slope stability as necessary geologic hazards that must be considered simultaneously with the other hazards.

In July 1972, shortly after this law went into effect, the cities of El Cerrito, Richmond and San Pablo undertook the Seismic Safety and Environmental Resources Study. It was funded by a "701" planning grant from the Department of Housing & Urban Development. The purpose of the study was to produce Seismic Safety, Open Space and Conservation Plans for the three cities and to generally encourage inter-city cooperation in environmental and safety planning matters.

The Seismic Safety Study was completed in September, 1973. This Element is a summary of that study; highlighting the findings and policies that were developed by the study participants. Reference should be made to the Seismic Safety Study itself for more detailed discussion of various geologic hazards. Copies of the study are located in the Richmond collection at the main branch of the Richmond Public Library.

Relation to other Elements

The Seismic Safety Element contributes information on the comparative safety of using lands for various purposes, types of structures and occupancies. It provides primary inputs to the land use, housing, open space and circulation elements.

Description of the Tri-Cities Planning Area

The Tri-Cities Planning Area includes the cities of El Cerrito, Richmond and San Pablo and certain unincorporated areas of Contra Costa County, including El Sobrante, North Richmond, East

Richmond Heights and Kensington (see Informational Map 1). It is bounded by the Contra Costa County boundary on the south, by the offshore County boundary within San Francisco Bay and San Pablo Bay on the west, by the Richmond City limits on the north, and generally by the Sobrante Ridge on the east. The Tri-Cities Planning Area is identical to the Richmond Planning Area except that it does not include portions of county land east of the San Pablo Reservoir or the County portion known as Tara Hills and Montalvin Manor.

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PART TWO
THE SEISMIC SAFETY ELEMENT

SECTION 1: GEOLOGIC HAZARDS

FAULT DISPLACEMENT

Findings

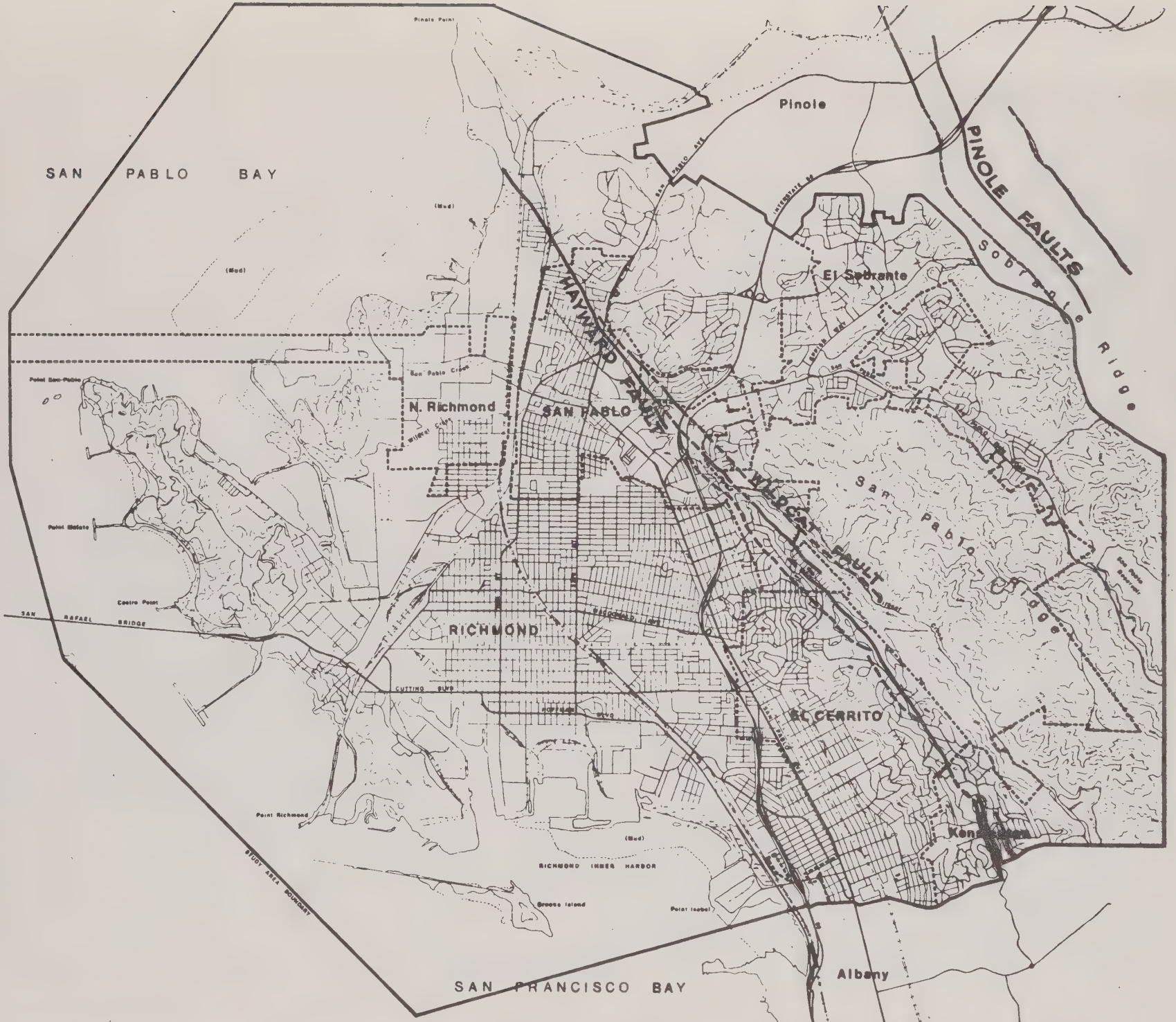
F1. The Hayward and Wildcat faults and a portion of the Pinole fault are considered to be active for those portions of the Tri-Cities Study Area shown on Informational Map 2. Faults are regarded as active if there is evidence of surface rupture in historic times (defined as 140 years) or if there is other geologic evidence suggesting fault movement.

F2. In the event of rupture during an earthquake, displacement may or may not be confined to a single fault trace, but could be manifested in a zone as much as several hundred feet wide along the mapped surface traces. This area is referred to as a fault zone. In the study area, such a fault zone encompasses both the Hayward and Wildcat faults, and another zone encompasses the Pinole fault.

F3. Some fault displacement results from fault creep, which is very slow periodic or episodic movement along a fault trace unaccompanied by earthquakes. Fault creep of about 1/2 centimeter per year has been noted at several places along the trace of the Hayward fault in Richmond and San Pablo.

Policies

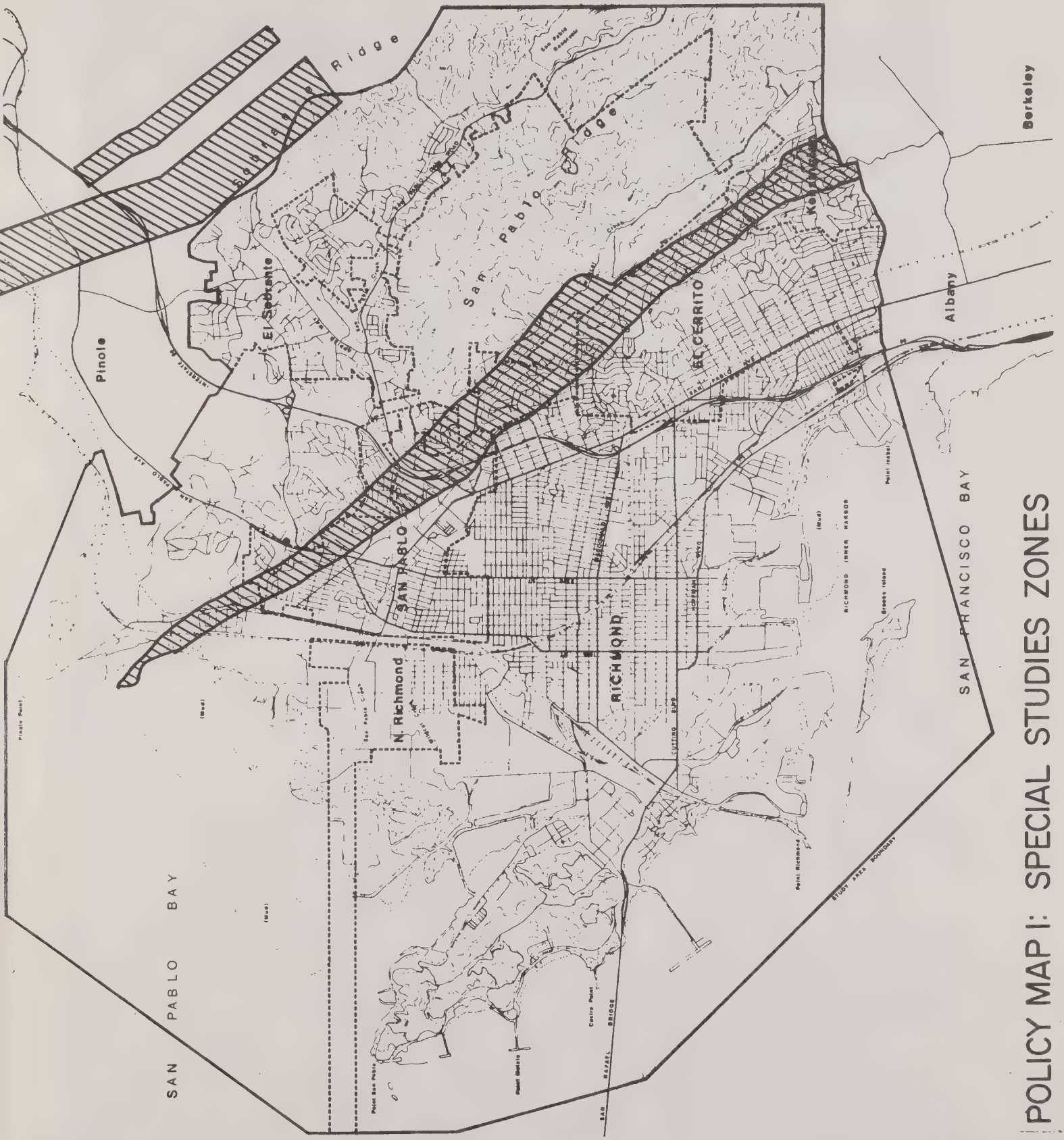
P1. Establish a Special Studies Zone (see Policy Map I) as required by the Alquist Priolo Geologic Hazards Zone Act of 1972. This Special Studies Zone cover areas designated by the State Geologist within which there exists a hazard to public safety from a possible fault rupture.



INFORMATIONAL MAP 2: ACTIVE FAULTS (Dashed where approximate)

Source: Bishop, 1973.

(Note: Detailed information cannot be presented accurately on maps of this scale. A large scale map of this subject is available for inspection at the Planning Departments of the participating cities.)



POLICY MAP I: SPECIAL STUDIES ZONES

(Note: Detailed information cannot be presented accurately on maps of this scale. A large scale map of this subject is available for inspection at the Planning Departments of the participating cities.)

FAULT DISPLACEMENT

The State Mining & Geology Board has formulated development policies affecting all applicants for real estate development and structures for human occupancy within the Special Studies Zones. Local jurisdictions are required to adopt these policies as part of their Seismic Safety Element and the Municipal Code. The policies, effective July 1, 1974, are as follows:

a. No structure for human occupancy, public or private, shall be permitted to be placed across the trace of an active fault. Furthermore, the area within fifty (50) feet of an active fault shall be assumed to be underlain by active branches of that fault unless and until proven otherwise by an appropriate geologic investigation and submission of a report by a geologist registered in the State of California. This 50 foot standard is intended to represent minimum criteria only for all structures. It is the opinion of the Board that certain essential or critical structures, such as high-rise buildings, hospitals, and schools should be subject to more restrictive criteria at the discretion of cities and counties.

b. Applications for all real estate developments and structures for human occupancy within Special Study Zones shall be accompanied by a geologic report prepared by a geologist registered in the State of California, and directed to the problem of potential surface fault displacement through the site, unless such studies are waived pursuant to Section 2623 of the Public Resources Code.

c. One (1) copy of all such geologic reports shall be filed with the State Geologist by the public body having jurisdiction within thirty (30) days of submission. The State Geologist shall place such reports on open file.

d. Requirements for geologic reports may be satisfied for a single 1 or 2 family residence, if, in the judgement of technically qualified City & County personnel, and with the approval

FAULT DISPLACEMENT

of the State Geologist, sufficient information regarding the site is available from previous studies in the same area.

e. Technically qualified personnel within or retained by each City or County must evaluate the geologic reports required herein and advise the body having jurisdication and authority.

f. Cities and counties may establish policies and criteria which are more restrictive than those established herein. In particular, the Board believes that comprehensive geologic and engineering studies should be required for any "critical" or "essential" structure as previously defined whether or not it is located within a special studies zone.

g. In accordance with Section 2625 of the Public Resources Codes each applicant for a building permit within a delineated Special Studies Zone shall pay to the City or County administering and complying with the ALQUIST-PRIOLO GEOLOGIC HAZARDS ZONES ACT, a fee of one-tenth of one percent of the total valuation of the proposed building construction for which the building permit is issued as determined by the local building official.

h. As used herein the following definitions apply:

1. A "structure for human occupancy" is one that is regularly, habitually or primarily occupied by humans; excluding therefrom freeways, roadways, bridges, railways, airport runways, and tunnels. The excluded transportation structures should be sited and designed with due consideration to the hazard of surface faulting. Mobile homes, whose body width exceed eight (8) feet, are considered as structures for human occupancy.

2. Only a geologist registered in the State of California is deemed to be technically qualified to evaluate geologic reports.

FAULT DISPLACEMENT

3. A "new real estate development" is defined as any new development of real property which contemplates the eventual construction of "structures for human occupancy."

P2. Establish regulations or administrative procedures that provide assurance that the possibility of fault movement is considered in the design of all roadways and utility lines which must cross through, and all important facilities which must be located within, the Special Studies Zone.

P3. Prohibit the development of new facilities within a Special Studies Zone which may have critical consequences if damaged by fault movement, such as hospitals, schools, utility structures and communication centers.

P4. Induce the removal or relocation of all facilities located within a Special Studies Zone which have a high occupancy potential (e.g. theaters, churches, major markets, apartment complexes, schools, etc.) to new sites away from the Special Studies Zone.

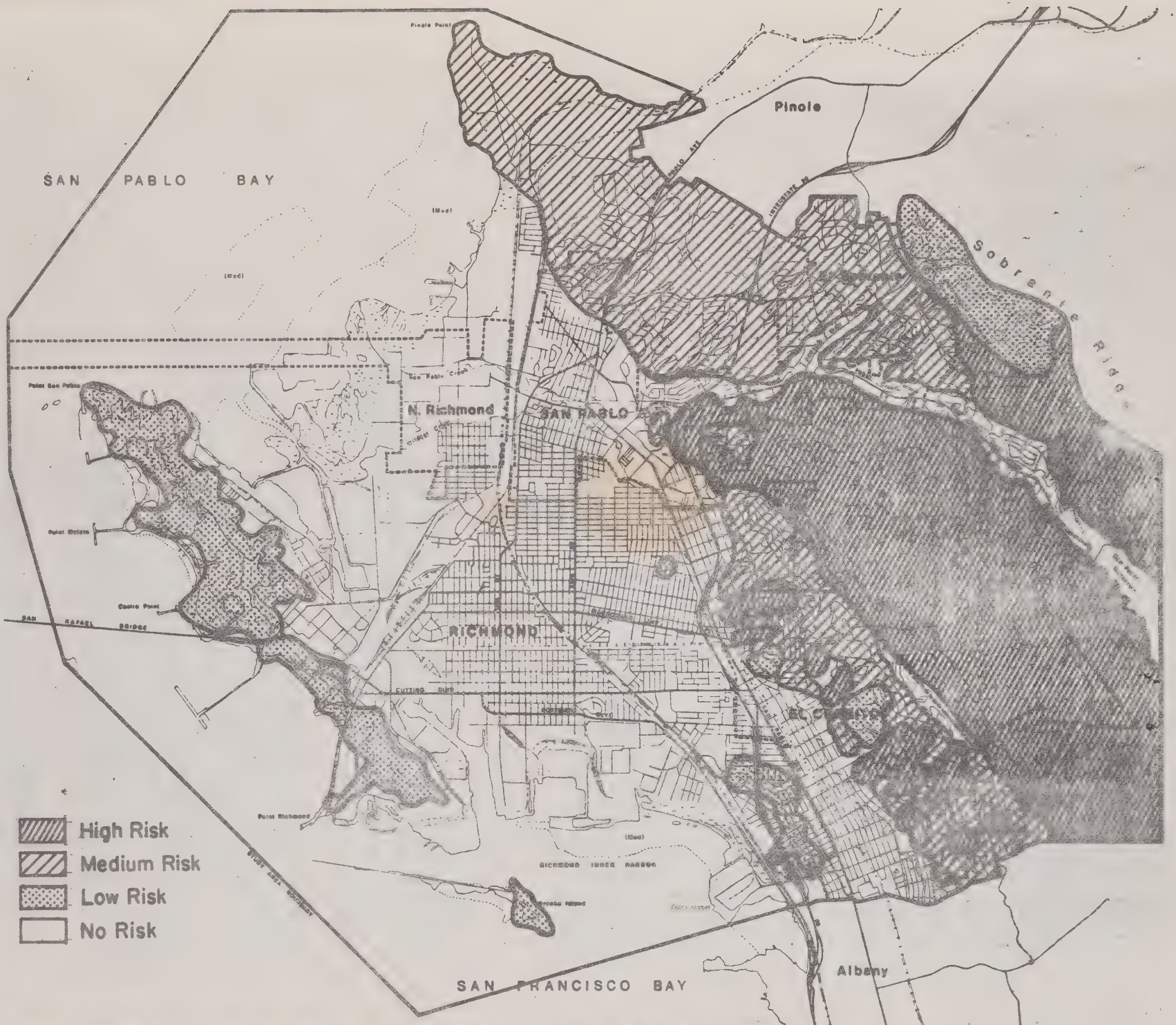
P5. Promote the least amount of day or night time occupancy of the Special Studies Zone. This can best be accomplished by limiting this zone to open space use. A secondary alternative is to limit development to low density, well-built, timber constructed dwellings.

SLOPE STABILITY AND LANDSLIDES

Findings

F1. Landsliding is a natural process of relatively rapid downslope movement of soil, rock and rock debris. The rate of landsliding is affected by the degree of water saturation, strength of rocks, slope angle, mass and thickness of deposit and type and extent of vegetative cover.

F2. Information Map 3 summarizes the findings on landsliding in the Tri-Cities area.



INFORMATIONAL MAP 3: LANDSLIDE RISK AREAS

Source: Bishop & Knox, 1973.

(Note: Detailed information cannot be presented accurately on maps of this scale. A large scale map of this subject is available for inspection at the Planning Departments of the participating cities.)

SLOPE STABILITY AND LANDSLIDES

Group I: High landslide risk area. This group includes all recognized landslides, landslide scarps, disturbed ground as well as ground observed to be susceptible to landsliding.

Group II: Medium landslide risk area. This group includes ground underlain by rocks which are prone to failure and/or ground having irregular topography suggestive of ancient landslides.

Group III: Low landslide risk area. This group consists of those hilly areas least likely to develop landslides. However, under certain conditions landsliding could occur.

Group IV. Landslide-free areas. This group includes relatively flat areas in which landslides are unlikely to occur.

Policies

P1. Encourage all utility companies and districts and direct City of Richmond controlled utility operations to develop and maintain up to date contingency plans in the event of a landslide within the high or medium risk areas.

P2. Establish a Critical Landslide Hazard Special Management Area for portions of the City of Richmond (see Policy Map 2) with appropriate enacting legislation which will:

a. Require an evaluation of landslide potential by a civil engineer specializing in foundations and an engineering geologist for construction within areas designated as high or medium risk on Information Map 3.

b. Establish standards or a permit procedure whereby extensive engineering work on hillsides may be permitted to stabilize

POLICY MAP 2: CRITICAL LANDSLIDE HAZARD SPECIAL MANAGEMENT AREA

(Note: Detailed information cannot be presented accurately on maps of this scale. A large scale map of this subject is available for inspection at the Planning Departments of the participating cities.)

SLOPE STABILITY AND LANDSLIDES

unstable land. This type of solution quite often results in unattractive subdivisions or other projects that cause tremendous destruction to the natural environment and therefore should be avoided wherever possible.

c. Encourage continued agricultural use, public acquisition or very low single family residential density within critical landslide areas. Amend the Residential Element of the Richmond General Plan to make it compatible with the Seismic Safety Element.

d. Prohibit the development of new facilities within areas designated as I or II, high or medium risk on Information Map 3, which may have critical consequences if damaged by landslides, such as hospitals, schools, utility structures and communication centers.

GROUND SHAKING

Findings

F1. The major damage to buildings during an earthquake is generally caused by ground shaking.

F2. Predictions of damage resulting from ground shaking is based on the concept that ground response is partly determined by the thickness of the alluvium or consolidated material overlying the bedrock. The Tri-Cities Area was divided into 4 zones based on the depth to bedrock (see Informational Map 4).

Zone I: This zone covers the area underlain by alluvial thickness of 50 feet or less. It represents the area of the shallowest deposits of alluvium, and is, generally speaking, the zone where low rise buildings are most vulnerable to damage.

Zone II. This zone covers the area underlain by 50 to 200 feet of alluvium.

INFORMATIONAL MAP 4: GROUND RESPONSE (Dashed where approximate)

Source: Rodgers & Bishop, 1973.

(Note: Detailed information cannot be presented accurately on maps of this scale. A large scale map of this subject is available for inspection at the Planning Departments of the participating cities.)

GROUND SHAKING

Zone III: This zone covers the area underlain by more than 200 feet of alluvium. It can be expected that high rise structures are very vulnerable to damage in this zone.

Zone IV: This zone shows the areas of bay mud and/or artificial fill outside the 1850 bay shoreline. The thickness of the alluvium has not been determined; therefore, the potential for damage for both low rise and high rise structures exists.

Zone V: This zone consists of areas with little or no soil cover. These areas will not experience as severe shaking as the other zones since a lack of soil cover does not allow amplification of shaking.

Policies

P1. Require a site investigation for any major or important structure to investigate the degree of ground shaking that can be expected for the particular structure.

P2. Encourage intelligent design and careful construction not only of structures but also in the use, anchorage and placement of its contents to reduce the hazard of falling objects from potential ground shaking.

LIQUEFACTION

Findings

F1. Liquefaction is a process by which an unconsolidated, water saturated sediment experiences a sudden loss of strength and coherance. The process may cause soil to act in a variety of ways - the soil may act like quicksand and have very little bearing strength; it may cause differential settlement and/or sliding along the liquefied layers; or it may cause structures to subside, tilt and move laterally.

LIQUEFACTION

F2. The following liquefaction potential map summarizes findings on the hazards of liquefaction in the Tri-Cities area. It is based upon the distribution of saturated sands in the alluvial portions of the study area (see Informational Map 5).

Zone I: High liquefaction hazard potential.
Zone II: High probability of liquefaction potential.
Zone III: Unknown; probability of liquefaction potential.
Zone IV: No liquefaction potential.

Policies

P1. Require an evaluation of liquefaction potential for all major or important structures as part of the foundation investigation needed for issuance of a building permit, except in Zone IV.

P2. Encourage utility companies to evaluate the hazard of potential damage from liquefaction in utility construction and to consider this hazard either in routing of the utilities or in details of construction or both.

TSUNAMIS

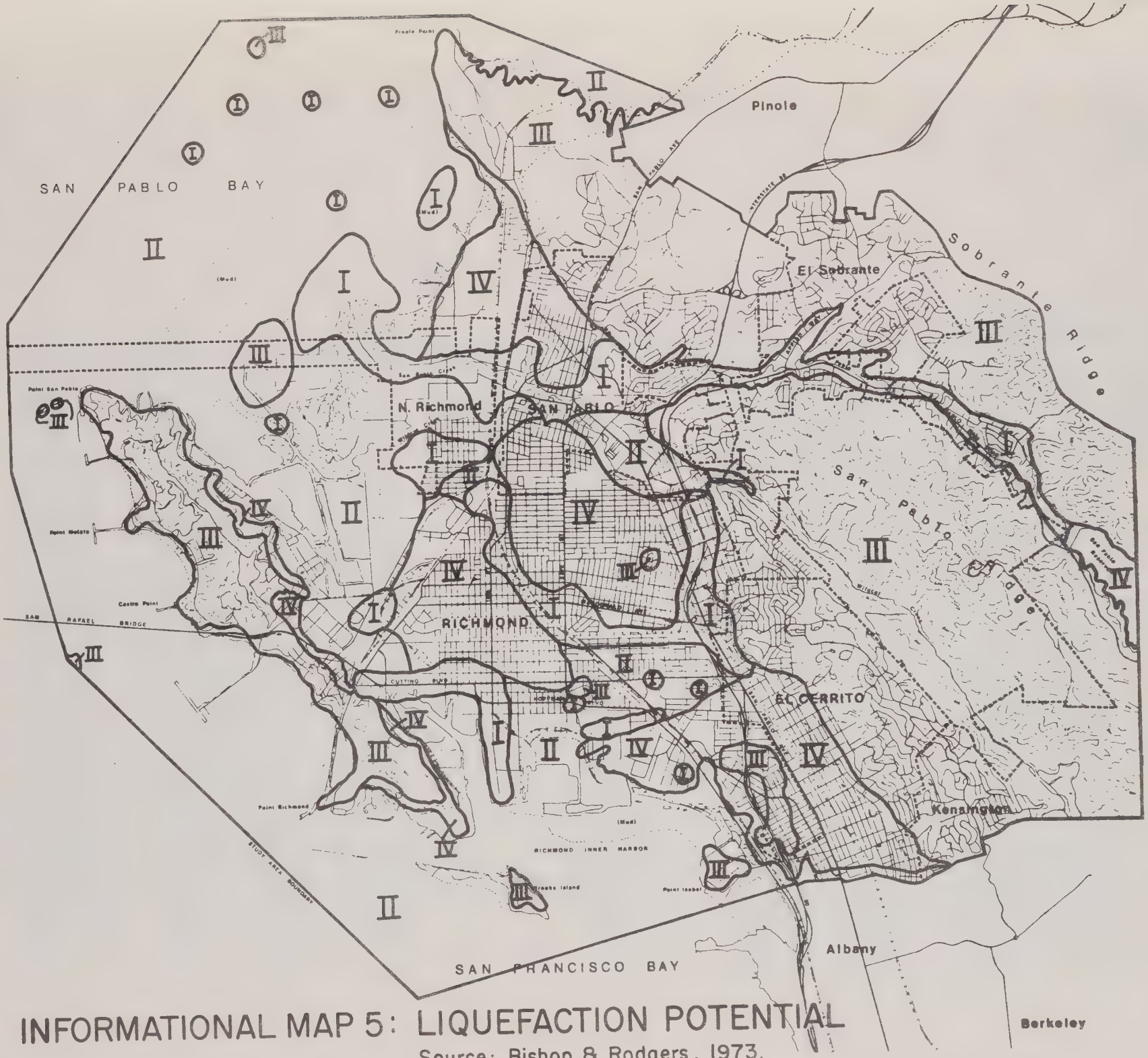
Findings

F1. Tsunamis are large ocean waves produced by submarine earthquakes or volcanic activity.

F2. Evidence indicates that the danger from tsunamis in the Tri-Cities area is slight and will probably be limited to low portions adjacent to the Bay, marshlands and certain industrial areas as well as Brickyard Cove in Richmond.

Policies

P1. Due to the minor potential of hazard from tsunamis, no policy is suggested at this time.



INFORMATIONAL MAP 5: LIQUEFACTION POTENTIAL

Source: Bishop & Rodgers, 1973.

(Note: Detailed information cannot be presented accurately on maps of this scale. A large scale map of this subject is available for inspection at the Planning Departments of the participating cities.)

SEICHES & DAM FAILURES

Findings

F1. Seiches are earthquake-generated waves within enclosed or restricted bodies of water such as lakes and reservoirs. Similar but even more catastrophic damage can result during earthquakes from a dam failure or from large masses of earth that might be broken loose and slide into a reservoir or the Bay.

F2. The major risk of seiches would be that earthquake movement of water within San Pablo Reservoir might burst the dam or overtop it. The East Bay Municipal Utilities District has recently undertaken an investigation into this possibility and found that overtopping the dam is extremely unlikely and should not be viewed as a danger.

POLICIES

P1. Encourage the East Bay Municipal Utility District to take whatever steps necessary to insure the safety from the possibility of seiches or dam failure.

SECTION 2

STRUCTURAL HAZARDS

PUBLIC BUILDINGS

Findings

F1. Most public buildings are of comparatively recent construction and have had the benefit of earthquake resistant design.

F2. Although public buildings are generally safe in the Tri-Cities area, the three City Halls and some of the fire stations may experience problems during an earthquake. The El Cerrito and San Pablo City Halls are old and their structural integrity may be generally questionable.

F3. Other Tri-Cities public buildings may become unavailable as centers of refuge because of their hazardous location with respect to faults, landslides or liquefaction zones.

PUBLIC BUILDINGS

F4. There is negligible hazard from falling parapets from public buildings with the possible exception of the City Halls of San Pablo and El Cerrito, the Richmond Plunge and the Contra Costa County Social Services Offices.

Policies

P1. Require a detailed structural investigation of the City Halls by a structural engineer and make available funds for modifications to the buildings as necessary.

P2. Periodically review the buildings which house the vital government functions necessary to coordinate post-disaster activity for their structural adequacy and ability to survive a major earthquake. All public buildings which cam serve as a refuge and as an administration area in the event of disaster should be designed to meet the most rigid earthquake standards. After the preliminary review, a more thorough investigation of certain structures may be necessary.

P3. Require geologic studies for all public buildings and structures located in a Fault Zone to determine whether or not the facility is subject to damage from ground rupture. If the studies indicate that damage is likely, corrective steps should be taken such as phasing out the facility.

FIRE STATIONS

Findings

F1. Six out of the fourteen fire houses within the Tri-Cities Study Area have serious deficiencies and may be unusable after an earthquake.

F2. Both of San Pablo's fire stations are made of unreinforced brick construction and are situated on ground that may tend to liquefy.

FIRE STATIONS

F3. In El Cerrito two of the fire stations (Kensington & Arlington) are located directly on top of the Hayward Fault.

F4. In Richmond, the more serious potential hazards are brick parapets and veneers, clay tile roofing, and the possible inadequate anchorage of timber roof and floors to the concrete walls in Fire House #4.

Policies

P1. Perform a more detailed and thorough investigation of all fire stations in the Study Area including their geological setting. The review should include access roads, utilities, etc.

SCHOOLS

Findings

F1. There are no pre-Field Act schools in El Cerrito or San Pablo. Within Richmond there are no such schools used by children.

F2. Although most of the schools meet the requirements of the Field Act, there may still be some degree of hazard in the schools. Since its adoption in 1933, the Field Act has been amended over the years to recognize and provide safeguards from more and more hazards. For instance, there was no requirement demanding consideration of geologic hazards to potential school sites until 1971.

F3. Although most of the schools meet the requirements of the Field Act, some may be subject to hazard because of their location with respect to geologically hazardous areas. Several schools are located within the Special Studies Zone, including the Sierra Elementary School in Richmond, Madera and Mira Vista Schools in El Cerrito and Contra Costa College, Bayview and El Portal in San Pablo. Several

SCHOOLS

schools are located in a zone of deep alluvium that is highly subject to liquefaction, including Rancho, Washington, Harry Ells High School, St. David's and St. Cornelius Schools in Richmond. John F. Kennedy School in Richmond is located in an area of high liquefaction potential. Three schools in El Cerrito--Mira Vista Annex, Cameron and Del Mar--are located on ground subject to landslide. El Portal Elementary School in San Pablo exhibits evidence of fault creep by offsets in paving and rather severe cracking in portions of the super structure. Some lower-lying buildings on the Contra Costa College Campus, El Portal Elementary School and the Helms Junior High School in San Pablo are located in zones of probable liquefaction.

Policies

P1. Inform the School District of the conditions found by the Seismic Safety Study relative to school structures. Request that the School District review in more detail the schools in or near suspected poor foundation materials, even though these schools technically meet the requirements of the Field Act and that all schools have a general review to determine the "minor" hazards of light fixtures, falling ceilings, arcades, book shelves and furniture, etc. If warranted, request the School District to take precautionary measures to reduce the effects of these hazards.

HIGHWAYS & UTILITIES

Findings

F1. Freeway overpasses can be expected to be damaged in an earthquake, therefore, emergency equipment may have to use alternate routes to get to emergency scene.

F2. In certain areas, landslides will affect secondary roads as well as freeways.

APARTMENT STRUCTURES

F3. Another major cause of damage will the effects of an error that became a part of the timber bracing section of the building codes some years ago. In small standard wood frame construction the 1970 Edition of the Uniform Building Code permits a let-in diagonal 1 x 4 brace to take lateral loads even without horizontal sheating. The 1971 San Fernando Earthquake showed the fallacy of this construction practice by the numerous failures of 1, 1 - 1/2 or 2 story wood frame residences.

F4. A third major cause of possible damage to apartments may result from designs that provide for an open concrete or masonry deck which houses automobile parking with one or more floors of wood frame construction on top of the deck. Because this type of construction has not yet been exposed to major earthquakes, no record of failures has been observed to date. However, it can be anticipated that a large amount of damage and some building failure will result.

Policies

P1. Adopt the provisions of the 1973 Uniform Building Code eliminating the let-in diagonal 1 x 4 brace to take lateral loads.

P2. Review in more detail the situation of the light wood frame construction apartment buildings on concrete stilts (to provide parking) in the light of present knowledge of performance of concrete frames in earthquakes.

CHURCHES

Findings

F1. The church buildings have several problems relating to parapet walls, concrete block construction, brick or stone

CHURCHES

ornamental veneer and clay tile on roofs. It must be assumed that at least some of these buildings will perform poorly due to these construction deficiencies.

F2. Tri-Cities churches are located generally in good geological areas and the life hazard in the churches would have to be ranked as fairly low.

Policies

P1. Make available the structural engineers' report to the churches for their review.

HOSPITALS & CONVALESCENT HOMES

Findings

F1. While most hospitals and convalescent buildings should perform adequately in earthquakes, damaged architectural, mechanical, electrical and operational facilities may force the elimination of these buildings from functional use after a disaster.

F2. Damage may result from medicines falling off shelves, from cabinets and equipment overturning, from ceilings and lights falling and from walls cracking.

F3. Although the majority of the convalescent buildings in the Tri-Cities area have the advantage of wood frame construction performance, they are subject to fire after an earthquake.

F4. The largest hospital in the study area, Brookside Hospital, may be inaccessible after an earthquake because of liquefaction of access roads.

HOSPITALS & CONVALESCENT HOMES

Policies

P1. Make available the structural engineers' report to the various hospitals and convalescent homes for their review.

SECTION 3

DISASTER PLANNING PROGRAM

Findings

F1. There are various Federal, State, and County agencies that assist local jurisdictions in providing a program of disaster preparedness. These agencies are as follows:

a. The California Office of Emergency Services (OES);

b. Contra Costa County Office of Emergency Services (County OES);

c. The California Fire and Rescue Emergency Plan;

d. California Law Enforcement Mutual Aid Plan;

e. San Francisco Bay Area Earthquake Response Planning Project.

F2. On the local level, only the City of Richmond has adopted a City Emergency Plan. The cities of San Pablo & El Cerrito completed, but as yet have not adopted, Emergency Plans. None of the cities have prepared supporting plans and Standard Operating Procedures for city emergency services. Training and orientation of City employees in emergency planning is almost non-existent in the three cities.

F3. The local police and fire services, Standard Oil and the utility companies

DISASTER PLANNING PROGRAM (con't)

are well organized internally and ready to respond to most emergencies.

Policies

P1. Develop a joint Tri-Cities Area Disaster Preparedness Program which will allow the cities to pool their resources and better coordinate a comprehensive program of disaster preparedness.

P2. Establish Emergency Operating Centers where key city personnel can direct and control emergency operations such as police and fire.

P3. Establish a program of public education and communication relating to natural disasters.

P4. Study the radio communication situation among essential services and provide funds so that radio communication capabilities are improved.

P5. Establish a Safety Commission or other similar board as the body that evaluates and makes recommendations concerning the adequacy of the local disaster preparedness program.

P6. Hold a joint earthquake response exercise when the three communities have upgraded their disaster response capability in order to test that capability in a simulated exercise.

PART THREE: IMPLEMENTATION MEASURES

Policies

P1. Create a Geologic and Seismic Hazards Review Board or Committee which would act as a policy and administrative body to assist in the implementation of policies adopted in the Seismic Safety Element. This body might be a citizen Geologic and Seismic Hazards Review Board, or a Design Review Board with expanded functions or a consultant hired to fulfill this responsibility.

P2. Continue the role of the Seismic Safety Citizens Advisory Committee. If the members are not part of the proposed Hazards Review Board or Committee, the members from any one of the cities could well serve that city in a continuing role as Citizens Seismic Safety Advisors at least for the next two years after the adoption of this element.

P3. Encourage the public acquisition of geologically hazardous lands, especially lands subject to fault displacement or landsliding. Initial priority should be given to parcels that have also been designated desirable for open space, trails, vista points and riparian and native woodlands in the Open Space and Conservation Plan Element.

P4. Establish new development regulations that will mandate the review, evaluation and restriction of land use that may be subject to undue risk in geologically hazardous areas. This proposed program should include the incorporation of requirements relating specifically to geologic hazards into subdivision, grading, zoning and other ordinances where needed. However, in closely regulating developments to prevent the creation of new hazards, it is important to remember that minimizing the cost of new housing is also

IMPLEMENTATION MEASURES

an important social goal.

P5. Appraise individual development projects in the earliest stages for the potential of significant geologic, seismic, soils and hydrologic problems. Detailed study and reporting should be made of seismic safety considerations in all Environmental Impact Reports. Those sections of an Environmental Impact Report dealing with geology should be produced, reviewed and approved by geo-technically competent persons prior to presentation of the report to designated city boards or commissions.

P6. Adopt the 1973 Uniform Building Code which has greatly improved earthquake provisions.

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